occur and a noise can be heard louder at a distance than at closer points.

Ground Absorption

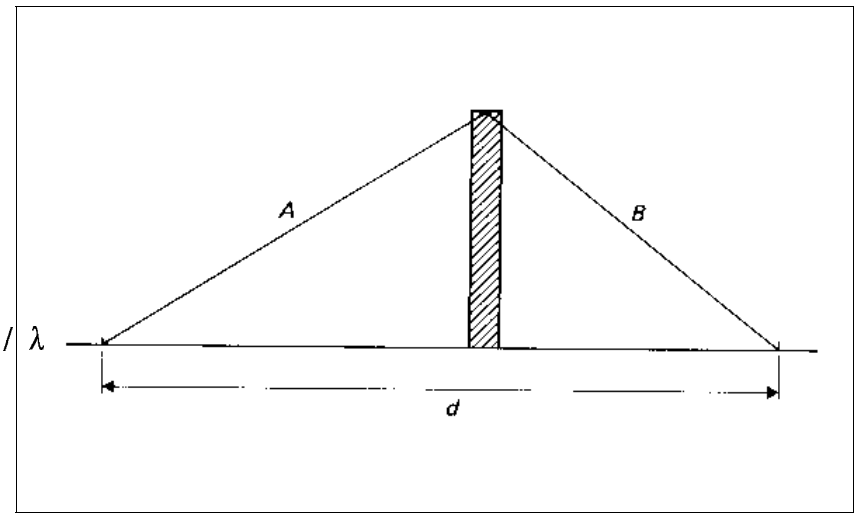
For source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces , noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening

Trees are often suggested as noise screens but they need to be tens of metres wide to provide reasonable attenuation. In addition they need to be evergreen to provide all year round performance. This does not negate the fact that trees can act as good sound reflectors back to the source, often causing echos.

Earth mounds, walls and cuttings can provide good attenuation. Because the wavelengths of sound are quite large at low frequencies, through diffraction effects the sound can bend over barriers. The performance of barriers is therefore frequency dependent. Barriers with two edges tend to perform better than those with a sharp edge eg. Walls. To avoid sound transmission through the barrier itself the superficial mass should be greater than 10 kg/m2.

Fig 12 Barrier Attenuation



For values of $2(A + B - d) / \lambda$ between 1 and 10 then attenuation is given approximately by:

$10 \log[2(A + B - d)/\lambda] + 13$ giving values between 13 and 23 dB.

Environmental Noise.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and sound pressure level. In general the ear is less sensitive at low frequencies.

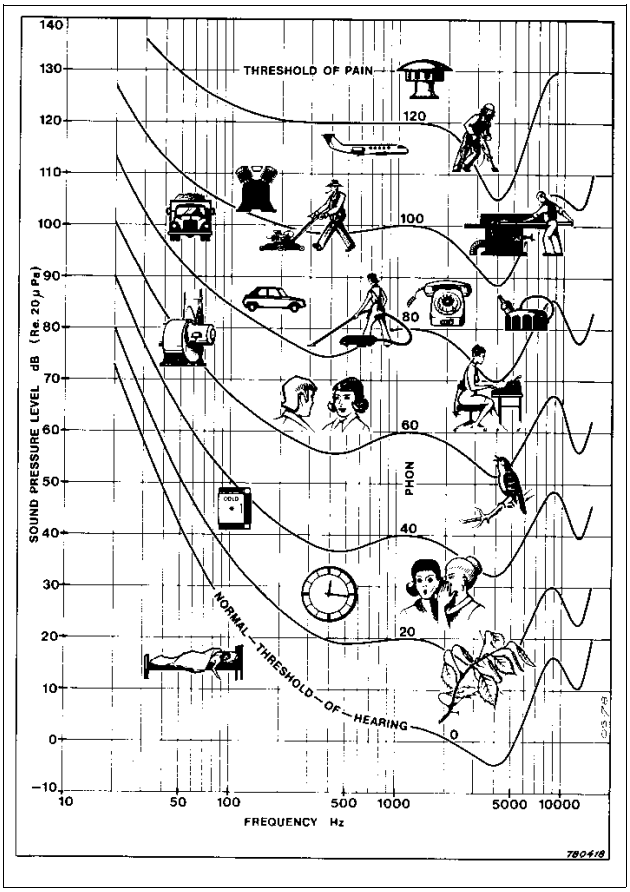


Fig 13 (Source ref 2) Equal loudness contours

Weighting scales have been included on sound level metres to give a measurement more closely related to subjective response to noise. The 'A' scale is the most weighted and was initially used for low level sounds. However it has been found to correspond most closely to subjective noisiness and is most commonly used in environmental noise measurements.